

**REMARKS
BEFORE THE SENATE
COMMUNICATIONS AND TECHNOLOGY COMMITTEE
BY
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Wednesday, April 6, 2011**

Thank you Chairman Folmer, Chair Farnese, Vice Chair Baker and members of the Committee. I am joined here today by my colleagues from three other of Pennsylvania's great research Universities, each of which are members of the prestigious American Association of Universities (AAU) and each of which are world-renowned for their prodigious science, engineering and medical enterprises. Added together, we account for \$2.5 billion in research each year, a number that places the Commonwealth of Pennsylvania in the top ten among states for total academic research. Recently, in a budget hearing, Dr. Mark Nordenburg, the President of the University of Pittsburgh, stated that the U.S. Department of Labor and Statistics estimates that for every million dollars expended on research, 35 jobs are directly created or sustained; based on that statistic alone these four universities are supporting 87,500 jobs just with their research.

In my remarks today, I will describe briefly the history of research at Penn State, how it is embedded in our basic mission, actually baked into our institutional DNA if you will, I describe briefly a few key areas in which we do research, and why this research and development work is important to the Commonwealth and, indeed, to the nation.

Dr. Evan Pugh was the first President of Penn State. He was a young man, the son of a black smith who spent his modest inheritance on his own education. Pugh left the

Commonwealth in the 1850s and ventured to Germany to earn his degrees in chemistry. At the universities of Gottingen and Heidelberg, he did pioneering work on how nitrogen is fixed by certain bacteria in soils for plants to use for growth. His was among the first work to study this process and it led to an understanding of how to benefit plant growth with synthetic fertilizers, which later ushered in the so-called “green revolution” in agriculture. Dr. Pugh established the curriculum at Penn State and was primarily responsible for Penn State becoming the first land grant university in the country, in the mid 1860s. The land grant universities were established by the Morrill act that was signed into law by President Abraham Lincoln during the Civil War. We trace our history back to Abe Lincoln and as a result he is the central figure in the historical fresco on the walls of Old Main’s foyer. The goals of the Morrill act were twofold: 1) to educate in the agricultural and mechanical arts anyone who had the wits and will to study, but not necessarily the funding and 2) to do scientific research that could be translated quickly to the field and into the classroom for the overall benefit of society. In fact so devoted was Dr. Pugh to doing research as well as teaching and administration that he kept his own chemistry laboratory for research in Old Main. Dr. Pugh set us on our course of integrating research, with teaching and outreach, a course that we follow to this day.

Between the 1860s and the 1940s, Penn State grew from the “Farmers High School” to a college and then into a university. In 1948 Dr. Eric Walker, then at Harvard University, moved to Penn State and brought with him the so-called Ordinance Research Laboratory. This was a laboratory that had done seminal work for the Navy during World War II, including radar, acoustics and underwater systems, but whose research was considered too applied to remain at Harvard. This was a significant event in Penn State’s

history because it brought research focused on our nation's defense to Penn State for the first time. The Ordinance lab became what we know today as the Applied Research Laboratory, or ARL, which is an Office of Naval Research UARC and a trusted agent for the U.S. government. Penn State as a result has more PhDs with security clearances on its campus than any other university in the country. The lab does between to \$150 and 200 million in research each year in areas such experimental and computational fluid mechanics, communications, intelligence and other areas for all branches of the military and the various "three letter" intelligence agencies, such as the CIA, the NSA and the NRO.

Dr. Walker went on to become the President of Penn State and in the early 1960s along with the Hershey trust he established the Medical Center. The Hershey Medical Center was meant to provide much needed health care to central Pennsylvanians. Later with the establishment of the Medical College a new focus was placed upon teaching and providing a steady supply of young doctors for our rural region. The Medical College then began to do research in the late 1970s and early 1980s. Among its early achievements, were the artificial heart and the heart pump assist device both of which kept patients with heart disease alive while they waited for transplants. Today, the Hershey Medical Center is home to the Children's Hospital, the Cancer Institute and one of the fastest growing medical research programs in the country. From humble origins in the 1970s, our medical research enterprise crossed the \$100 million dollar mark this year, a notable accomplishment for a relatively young medical school working in the most competitive field of scientific research.

Today, Penn State is one of the top universities in the world. Our total research expenditures were just under \$800 million this past year placing Penn State ninth in the country in total research. While our medical research enterprise on national is small to moderate in size, but growing quickly, our research in the basic and engineering sciences is among the very best and largest in the US. We are ranked first or second in defense related research, and among the highest in energy research and industrially funded research. Our corporate sponsors of research include most of the Fortune 500; corporations such as US Steel, United Technologies, Boeing, Lockheed Martin, Merck, Northrop Grumman, IBM, PPG, CSC, Bayer and many more are involved in doing research with us. At the same time we also work with small and medium sized companies, and we spin out startups with core technology based on our research.

This past fall the Wall Street Journal ranked Penn State number one in the country among corporations seeking to recruit young people into their organizations as engineers, scientists, accountants, salespeople et cetera. It was stated that Penn State's strength in research is one of the main reasons that corporations come to recruit young people from us – in other words they know us through our strong research interactions with them and this pays off handsomely for our undergraduates. Faculty research is so strong in areas such as supply chain management, computer and network security, data fusion, rotorcraft engineering, electro ceramics, polymer science, fuel cells, batteries, family studies, nutrition, exercise, organizational psychology and more, that corporations and government agencies come to us for answers and take our students back with them as they leave the campus!

I want to share a few recent examples of areas of research that give a better sense of what “research” means at Penn State today. Let me begin with social science. As you know, the last ten years have been times of very high stress for the men and women in the armed services and for their families as well. This stress leads to behaviors in the family that the military wants to understand in order to prevent by providing services and training to curtail and diminish domestic violence, depression and suicide among our veterans. Military doctors and psychologists want to be able to better prepare families for the challenges of long periods of deployment and for readjustment upon completion of their tours of duty. Penn State faculty members in our Social Science Research Institute and our Center for Children Youth and Family are working hand in hand with the US Marine Corps to analyze these problems and to find solutions for them, not tomorrow, but today.

Another area of excellence for us is in supply chain management. Our faculty in this area are considered to be the best in the world. Every year the Marine Corps sends officers who are on active duty to the Smeal School of Business to learn all that they can and to bring it back to Corps. The USMC is considered to be the leanest, and most effective fighting force among all our armed services and the other services look to the Marines for innovation. I am proud to say that Penn State is a part of that innovation.

Last year, after a nation-wide competition, faculty in our department of computer science and engineering won a competition for an Army Research Laboratory Collaborative Technology Alliance funded Academic Research Center focused on network communications and security. This award alone was for almost \$33.5 million dollars over ten years. The same faculty members work with the best corporations in the

business to help solve their most pressing network security problems and to educate students in this important area of research and application.

Researchers in our ARL are working to support the war fighter in Afghanistan and Iraq, indeed around the world, with better intelligence and situational awareness on the ground. But at the same time, closer to home, they are also working with the DEA and the Coast Guard in the war on drugs by assisting in the interdiction of drug smugglers along our southern coast and borders.

Energy has always been a high point of Penn State's research portfolio. As you know the Marcellus Shale find is one of the most promising energy discoveries ever made in Pennsylvania. The Governor and his team have recognized that this resource can have a profound effect on the Commonwealth of Pennsylvania's economy for many decades to come. I am very proud of the fact that this find and the estimates of its size were based upon painstaking research done over 23 years by a now well-known Penn State geoscientist – Dr. Terry Engelder. Dr. Engelder stayed the course for over two decades, doing his careful science and creating the empirical basis for his estimates of the magnitude of the gas locked within the Shale. When he announced a few years ago that this was super giant field, people in the industry took note because his claims were made on fact-based science. The rest is as the say history. I am also pleased to tell you that many of the developers of the Marcellus Shale are engineers and business people who graduated from Penn State and, especially, from our college of Earth and Mineral Sciences. Mr. Terry Pegula graduated from the College in 1973 and founded East Resources with a small loan from his parents in the early 1980s. He is an example of the kind of person who came to Penn State, learned a profession and then went out and

changed the world with know-how and grit. In the last few years as Penn State faculty do new research in the geosciences and develop new drilling technology based on this science and teach about it in the classroom, other faculty in the extension services have helped landowners understand the intricacies of leasing their land and managing their new found extra incomes. In other words, the whole Marcellus Shale story from discovery to recovery is a great chapter in Penn State's history as a land grant institution.

We have been and continue to do research in other forms of fossil energy and alternative energy research around campus. We have a world renowned engineering science group that has been researching the complexities of combustion in order to enhance the effective use of fossil fuels. We have a long-standing group working in all aspects of coal science including clean up of coal as well as carbon capture and sequestration. We were one of the first universities in the 1950s to build a nuclear reactor to do research and to teach nuclear engineering and science. Our agricultural scientists are using the latest techniques in biotechnology to produce varieties of plants such as switch grass that grows fast and provides a very high biomass yield per acre, biomass that can then be converted into bio-fuels. We also have chemists, physicists and engineers researching the conversion of sunlight into fuels like hydrogen via new kinds of photo systems that mimic natural systems.

I am very proud to tell you that along with CMU, UPenn and UPitt this past year; we competed nationally for a DOE-funded Energy Hub focused on energy efficient buildings. This HUB is meant to provide new science and engineering practices for the conversion and renovation of existing buildings into energy efficient spaces. Today, the US expends nearly 40% of its energy usage on heating, lighting, ventilating and air

conditioning buildings. Our goal is to help cut this in half by 2025. By doing this we not only will help the environment, we will also help to cut our dependence on foreign oil drastically. The HUB will bring 129 million in new federal R&D dollars to the Commonwealth over the next five years and it is renewable for five more years. This HUB will make the Philadelphia Navy Yard and the region around it an international hot bed for R&D in this vital area and will place Pennsylvania and the US in the lead worldwide in developing these new building technologies.

I hope that these examples give you a better understanding and appreciation for how much Penn State and our sister Carnegie Research I institutions represented here bring to the Commonwealth of Pennsylvania through their R&D enterprises. I will be happy to answer any questions you may have for me about any aspect of Penn State research today or at any time in the future.